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Revision of the Genus Triplasis.

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This group of plants has been frequently considered a part of the genus *Triodia*, founded by Robert Brown on a number of Australian grasses which bear little more than a superficial resemblance to our plants. Hackel * so considered the group, but Bentham & Hooker † adopted the views of Beauvois and gave to it the dignity of generic rank. It has seemed to us for some time that the genus *Triodia* embraced too many forms and that it would be much more satisfactory to divide it into several smaller groups. *Triplasis* approaches most closely to those plants that have been referred to *Triodia* under the specific names of *avenacea*, *pulchella*, *Nealleyi*, etc. The flowering scales are deeply 2-lobed as they are in those plants, but the internodes of the rachilla of the spikelet in *Triplasis* are much elongated and the callus is very long, sometimes two thirds as long as the internodes, and attached to the rachilla by a long oblique angle. The callus being densely pilose on the free side gives the rachilla internodes the appearance of being pilose on one side for a part of their length. This long and manifest callus with its very evident oblique attachment is a character not known to us to occur in any other of the many forms that have been referred from time to time to *Triodia*. The conclusions of Beauvois certainly seem tenable and better serve the end of systematic botany than does

* Engl. & Prantl, Nat. Pflanzenfam. 2^2: 68. 1887.

† Gen. Plant. 3^2: 1176. 1883.

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the alternative, the merging of the group with a genus that has, under present conceptions, already passed far beyond the bounds of reason or expediency by having incorporated in it a number of well-marked groups that might much better be treated as genera.

The genus *Triplasis* is not a large one, nor is it extensively distributed, its three species being confined to North America east of the Rocky Mountains, and mainly to the vicinity of the coast, but one species, *T. purpurea*, occurs in the interior. The other two are found only in the coastal region south of Virginia, one of them, *T. intermedia*, being known at present only from Florida.

TRIPLASIS Beauv. Agrost. 81, *pl. 16. f. 10.* 1812.

[DIPLOCEA Raf. Am. Journ. Sci. **1**: 252. 1818.]

[MERISACHNE Steud. Syn. Pl. Gram. 117. 1855.]

Tufted grasses with simple or sparingly branched culms, narrow flat leaves which are usually involute when dry, and terminal and lateral few-branched panicles, the latter concealed in the sheaths. Spikelets few, on short pedicels, 2–4-flowered, the flowers perfect or the upper one staminate; rachilla glabrous, the internodes above the first flowering scale much elongated. Scales 4–6, usually purple or purplish: outer 2 empty, keeled, 1-nerved, acute or acuminate: flowering scales deeply 2-lobed at the apex, the lobes truncate to acuminate and pointed, 3-nerved, the nerves densely pilose with ascending hairs, the awn arising between the lobes, shorter than or exceeding them, pilose for part of its length; callus manifest, densely pilose, wedge-shaped or subulate, obliquely attached to the rachilla, its hairs making the internodes appear as if pilose on one side for part of their length: palet shorter than the scale, compressed, 2-nerved, the nerves pilose, the hairs on the lower part short, those on the upper part abruptly much longer and forming a conspicuous tuft. Stamens 3. Styles short, distinct: stigmas plumose. Grain cylindric, free, loosely enclosed in the scale and palet.

Species 3, confined to North America, principally in the eastern and southern portions.

Key to the Species.

Flowering scale one third or more as broad as long, with a shorter straight awn 3 mm. or less long.

Lobes of the flowering scale rounded or truncate at the irregularly and minutely toothed apex; awn less than 2 mm. long. 1. *T. purpurea.*

Lobes of the flowering scale acute or acutish at the apex; awn 2.5–3 mm. long. 2. *T. intermedia.*

Flowering scale one fifth as broad as long, its lobes acuminate, pointed, the awn longer than the scale, 6 mm. or more in length, recurved, at least when dry.

3. *T. Americana.*

1. TRIPLASIS PURPUREA (Walt.) Chapm. Fl. South. U. S. 560. 1860.

Aira purpurea Walt. Fl. Car. 78. 1788.
Uralepis aristulata Nutt. Gen. 1: 63. 1818.
Diplocea barbata Raf. Am. Journ. Sci. 1: 253. 1818.
Tricuspis purpurea A. Gray, Man. 589. 1848.
Merisachne Drummondii Steud. Syn. Pl. Gram. 117. 1855.
Triplasis sparsiflora Chapm. Fl. South. U. S. 663. 1884. [2d Ed.]

Culms 2–8 dm. tall, usually less than 6 dm., simple or finally slightly branched, the lower internodes roughened with a minute pubescence, at least below the nodes, and also occasionally sparingly hirsute; nodes numerous, densely upwardly barbed with silky hairs: leaves numerous; sheaths shorter than the internodes, rough, the lower ones sometimes papillose-hirsute at the base; ligule a dense ring of hairs less than 1 mm. long; blades erect or ascending, flat, or involute when dry, less than 15 cm. long, 1–3 mm. wide, rough on both surfaces, the upper surface usually sparingly hirsute, the uppermost leaf reduced to a point: panicle at length exserted, the axis smooth and glabrous, the roughened branches in 1's or 2's, finally widely spreading, 4 cm. or less long, the lower ones usually divided: spikelets on short hispidulous pedicels, usually purple: scales 4 or 5; outer empty 2 acuminate, the first about two thirds as long as the second, which is 3–4 mm. long; flowering scales divided about one quarter way down, the lobes rounded or truncate at the irregularly and minutely toothed apex, the awn equalling or a little exceeding the lobes, pilose on the lower half, less than 2 mm. long, the lowest scale about 4 mm. long, 1.75 mm. wide when spread out: palet shorter than the scale: grain about 2 mm. long.

In sandy soil, usually along the coast, Ontaria to Florida, west to Texas; also along the Great Lakes and from Missouri and Nebraska southward.

The *T. sparsiflora* of Chapman appears to us to be but a form of this species. Mr. C. D. Beadle, Curator of the Biltmore Herbarium, kindly sent us for examination the type specimen. It proves to be a smut-infested plant and therefore a very unsatisfac-

tory one to determine properly, its scales necessarily being abnormal. The whole plant has a very odd look, the inflorescence appearing to be a long narrow panicle. A more careful examination, however, reveals the cause of this unique inflorescence in the breaking away of the upper sheaths, thus exposing the secondary and usually concealed panicles, which are present in the late stage of the species of this genus. This is clearly indicated by the swollen pubescent nodes which occur throughout its length. So far as can be judged from the imperfect condition of the plant, the type specimen, as indicated previously, appears to be but a form of *T. purpurea*, and, for the present at least, its disposition under this species seems to us best. Good specimens may be secured later, and then a correct valuation can be placed upon it. The specimen was collected on the "Sea beach at Punta Rosa, Florida, October, 1875."

2. TRIPLASIS INTERMEDIA sp. nov.

Culms densely tufted, 4–8 dm. tall, slender, smooth, more or less hirsute below with appressed or ascending hairs, simple or at length somewhat branched at the lower nodes; nodes numerous, densely and conspicuously upwardly barbed with silvery hairs: leaves numerous; sheaths from one half to three quarters as long as the internodes, very rough, papillose-hirsute towards the base with long ascending hairs; ligule a dense ring of hairs 1 mm. or less long; blades erect or ascending, 13 cm. or less long, the uppermost one reduced to a mere point, involute when dry, very rough on both surfaces and on the margins, hirsute above and sometimes also sparingly below, scantily papillose-ciliate with very long hairs: panicle at length exserted, the branches in 1's–3's, usually in pairs, finally widely spreading, pubescent at the base, rough, the longer ones 2–4 cm. long and more or less divided: spikelets on short pubescent pedicels, 8–10 mm. long, usually purplish: scales 5 or 6, the sixth when present empty; outer 2 empty scales acuminate, rough on the keel, about equal in length, or the first considerably shorter than the second, which is 4–4.5 mm. long; flowering scales divided from one quarter to one third their length, the lobes acute to somewhat obtuse, the callus subulate, about one half as long as the rachilla internodes, the hairs on the lateral nerves about .5 mm. long, much longer than those on the midnerve, the awn 2.5–3 mm. long, straight, much exceeding the scale, the lowest scale about 4.5 mm. long, 1.5 mm. wide; palet about three quarters as long as the scale: stamens purple, 1.75–2 mm. long.

Dry sandy soil, south peninsular Florida. Collected by the writer at Ballast Point, near Tampa, in the vicinity of the Pavillion, on August 20, 1895, no. 2426. It grew in great abundance about one hundred feet from the shore, forming large dense tufts.

3. TRIPLASIS AMERICANA Beauv. Agrost. 81, *pl. 16. f. 10.* 1812.
Uralepis purpurea Nutt. Gen. 1: 62. 1818.
Uralepis cornuti Ell. Bot. S. C. & Ga. 1: 580. 1821.

Culms 3–8 dm. tall, slender, smooth, puberulent, the lower internodes also hirsute with nearly appressed hairs, simple; nodes numerous, sparingly, if at all, barbed: leaves numerous; sheaths much shorter than the internodes, smooth, the lower ones hirsute, often sparingly so, with nearly appressed hairs; ligule a scarious ciliolate ring less than .5 mm. broad; blades flat, usually involute when dry, erect or ascending, 15 cm. or less long, less than 2 mm. wide, the uppermost leaf reduced to a point, rough on the margins, smooth on both surfaces, glabrous beneath or with a few long scattered hairs, the upper surface minutely pubescent, sometimes also with scattered long hairs: panicle at length exserted, the axis smooth and glabrous, the branches ascending, single or in pairs, glabrous, somewhat scabrous, simple or sparingly divided, 3 cm. or less long: spikelets on short hispidulous pedicels, usually purple, the callus subulate, about two thirds as long as the rachilla internodes: scales 4 or 5; outer empty 2 acuminate, the first three quarters or more as long as the second which is 3–4 mm. long; flowering scales divided to the middle, the lobes subulate, acuminate, pointed, the awn much exceeding the scale, usually reflexed, at least when dry, pilose for about two thirds its length, 6–8 mm. long, the lowest scale about 5 mm. long, about 1 mm. broad: palet a little more than one half as long as the scale: grain about 2 mm. long.

Dry sandy soil along the coast, North Carolina to Florida, west to Texas.

Piperaceae Bolivianae.

By Casimir De Candolle.

PIPER L.

Sectio 2. Enckea C. DC. Prodr. **16**[1] : 243.

1. P. TENUE Kunth in H. et B. Nov. Gen. **1** : 56.

In Bolivia ad confluentem fluminum Beni et Madre de Dios (Rusby, no. 2184 in Herb. Boiss.).

Sectio 3. Steffensia C. DC. *l. c.*, 251.

2. P. Warakaboura C. DC. Prodr. **16**[1] : 257.

In Bolivia ad confluentem fluminum Beni et Madre de Dios, Augusto (Rusby, no. 2182 in Herb. Columbia University).

3. P. Bangii C. DC. Bull. Torr. Bot. Club, **19** : 49. 1892.

In Boliviae prov. Yungas (Rusby, no. 330a in Herb. Columbia University).

4. P. LANCEOLATUM R. et Pav. Fl. Per. **1** : 36. *pl. 61, f. b.*

Unduavi in Bolivia, alt. 8,000 ped. (Rusby, no. 2178 in Herb. Boiss.).

5. P. PSILOPHYLLUM C. DC. Bull. Torr. Bot. Club, **19** : 47. 1892.

Limbi apice acuminati in sicco pallide virescentes et subglaucescentes.

In Bolivia (Rusby, no. 2900 in Herb. Cand.).

6. P. TRICHORHACHIS, foliis breviter petiolatis glabris oblongo-ellipticis basi leviter inaequali acutis apice acuminatis, nervo centrali ex ½–⅓ longitudinis nervos adscendentes utrinque 5 mittente petiolo basi ima vaginante, pedunculo glabro petiolum 2–3plo superante, amento quam folii limbus breviore floribus spiraliter insertis rhachi hirsuta, bracteae vertice lunulato carnoso margine praesertim antice hirsuto pedicello utrinque hirsuto, bacca subtetragona ad rhachin elongata glabraque.

In Boliviae prov. Yungas, Decembri (Weddel, no. 4264 in Herb. Mus. Par.).

Ramuli glabri laeves, amentiferi circiter 2 mm. crassi. Collenchymatis fasciculi discreti in sectione transversali transverse elon-

gati et zona interna parce libriformes, fasciculi intramedullares 1-seriati. Limbi in sicco coriacei nitidi opaci pallescentes parce fusco-punctulati, circiter 13 cm. longi, 5 cm. lati. Petioli circiter 6 mm. longi. Amenta submatura 3 mm. crassa, fere 7 cm. longa. Stamina 4. Stigmata 3, sessilia, brevia.

7. P. TRIGONIASTRIFOLIUM, foliis brevissime petiolatis lanceolatis basi leviter inaequali acutis apice longiuscule acuminatis utrinque glabris, nervo centrali vix ad ½ longitudinis suae nervos alternos adscendentes utrinque 4–5 mittente, petiolo basi ima vaginante, pedunculo petiolum aequante glabro, amento quam folium dimidio breviore apice subacuto, bracteae vertice truncato triangulari margine pedicelloque lato hirsutis, bacca subtetragona vertice hirsuta, rhachi hirtella.

In Bolivia (Bang, no. 2197 in Herb. Cand.).

Ramuli glabri laeves, amentiferi 2.5 mm. crassi, collenchymatis fasciculi discreti zona interna libriforme, fasciculi intramedullares 1-seriati. Limbi in sicco coriacei opaci pellucido-punctulati glaucescentes ad 14 cm. longi et ad 5 cm. lati. Petioli vix 5 mm. longi. Amenta fere matura, circiter 5 mm. crassa. Stamina 4, stigmata 3 sessilia linearia.

8. P. BOLIVIANUM C. DC. Prodr. **16**[1]: 280.

In Boliviae prov. Yungas (Rusby, no. 540 in Herb. Columbia University).

9. P. RUSBYI C. DC. Bull. Torr. Bot. Club, **19**: 47. 1892.

In Boliviae prov. Yungas (Weddel, no. 2296 in Herb. Mus. Par.).

10. P. GAUDICHAUDIANUM Kunth, Linnaea, **13**: 639. 1839.

In Prov. Yungas (Rusby, no. 345 in Herb. Boiss.).

11. P. ACUTIFOLIUM R. et. Pav. Fl. Per. **1**: 38. *pl. 64, f. a.*

In prov. Yungas (Rusby, no. 215 in Herb. Boiss.).

12. P. OBLIQUUM R. et Pav. Fl. Per. **1**: 37. *pl. 63. f. a.*

Ad Mapiri (Rusby, no. 2174 in Herb. Boiss.).

13. P. BLANCHETII C. DC. Prodr. **16**[1]: 318.

Ad confluentem fluminum Beni et Madre de Dios (Rusby, no. 2183 in Herb. Boiss.).

Sectio 4. Carpunya C. DC. **16**[1]: 326.

14. P. PAULOWNIFOLIUM C. DC. (in Durand et Pitt. Primit.).

In Bolivia (Rusby, no. 2640 in Herb. Columbia University).

Sectio 5. Potomorphe C. DC. Prodr. **16**[1]: 331.

15. P. UMBELLATUM Willd. Sp. Pl. **1**: 166.
Ad Mapiri (Rusby, no. 2173 in Herb. Boiss.).

16. P. PELTATUM L. Sp. Pl. 42. 1762.
In Bolivia (Bang, no. 1607 in Herb. Boiss.).

PEPEROMIA R. et Pav.

A. Amenta in apice caulis paniculatim disposita.

1. P. VESTITA, foliis longiuscule petiolatis oblongo-ellipticis basi acutis apice obtusis utrinque dense tomentosis, nervo centrali nervos adscendentes utrinque 4–5 mittente, amentis in apice caulis paniculatim dispositis ipsis quam folia brevioribus et brevissime pedunculatis, bractea orbiculari, ovario emerso ovato basi breviter angustato apice longiuscule et oblique rostrato sub rostro antice stigmatifero.

In Bolivia (Bang, no. 2645 in Herb. Columbia University).

Herba ut videtur erecta caule dense tomentoso. Limbi in sicco membranacei crebre pellucido-punctati ad 10.5 cm. longi et ad 4.5 cm. lati. Petioli fere 3 cm. longi, dense tomentosi. Panicula tomentosa ramosa circiter 20 cm. longa, ramis subverticillatim amentiferis. Amenta filiformia fere ad 7 cm. longa et densiflora, squamis oblongis (?) cito caducis fulta. Antherae rotundatae quam filamenta breviores. Stigma globosum minute papillosulum.

B. Amenta in foliorum axillis solitaria aut terminalia aut apice ramuli geminata.

§ 1. *Ovarium apice stiliferum aut saltem sub stigmate distincte attenuatum.*

2. P. PARVIFOLIA C. DC. Seem. Journ. **4**: 133. 1866.
In Bolivia (Rusby, no. 1860 in Herb. Columbia University).

3. P. UMBILICATA R. et Pav. Fl. Per. **1**: 30. *pl. 45. f. b.*
α macrophylla C. DC. in Prodr. **16**[1]: 394.

In Bolivia (Rusby, no. 2448 in Herb. Columbia University).

4. P. MANDONII C DC. *l. c.*, 395.
Ibid. (Rusby, no. 1719 in Herb. Columbia University).

5. P. BRITTONII C. DC. Bull. Torr. Bot. Club, **19**: 254. 1892.
Post: *foliis ternis*, adde: *ovatis*.

§ 2. *Ovarium neque stiliferum neque sub stigmate attenuatum.*

* *Folia alterna.*

† *Ovarium stigma in apice summo aut paullo infra apicem et oblique gerens.*

6. P. TALINIFOLIA Kunth, H.B.K. Nov. Gen. 1: *62. pl. 8.*

In prov. Yungas (Rusby, no. 330 in Herb. Boiss.).

7. P. SORATANA, foliis longiuscule petiolatis adultis oblongo-lanceolatis supra ad nervos et subtus ubique pilosulis 5-nerviis, amentis longiuscule pedunculatis axillaribus terminalibusque filiformibus adultis folia parum superantibus, bractea orbiculari ovario emerso obovato apice obtuso et oblique stigmatifero.

In provincia Larecaja viciniis Sorata Quiliguaya ad rivum in nemoribus, alt. 2800 m. Septembri (Mandon, no. 1115 in Herb. Mus. Par.).

Herba erecta (?) caule pilosulo inferne radicante in sicco complanato et ad 6 mm. crasso. Limbi ad 9 cm. longi et ad 2.5 cm. lati in sicco membranacei pellucido-punctulati. Petioli 2.5 cm. longi. Amenta densiflora. Bractea et ovarium in sicco fusco-punctulata. Stigma carnosum et glabrum.

8. P. ADENOCARPA, foliis modice petiolatis ellipticis basi ima subacutis apice obtusis utrinque subdense pilosis 3-nerviis, amentis axillaribus terminalibusque, folia parum superantibus filiformibus, bractea orbiculari, bacca emersa rotundato-ovata in sicco glandulis rugulosa et apice oblique rostellata.

In provincia Larecaja viciniis Sorata Quiliguaya ad rivum in umbrosis, alt. 2700 m., Aprilli (Mandon, no. 1116 in Herb. Mus. Par.).

Herba caule e basi radicante erecto et simplici 25 cm. longoi dense pilosulo in sicco filiformi, internodiis fere 1 cm. longis. Limbi 2–3.5 cm. longi et 1.5 cm. lati in sicco tenuiter membranace, et pellucidi. Petioli ad 7 mm. longi, pilosuli. Amenta subdensiflora. Bacca 1 mm. paullo superans.

9. P. DUMETICOLA, foliis modice petiolatis subdensis ovatis utrinque obtusis supra ad nervos et subtus ubique et subdense pilosis fusco-punctulatisque 5-nerviis, amentis axillaribus terminalibusque modice pedunculatis ipsis filiformibus et folia vix duplo superantibus, bractea orbiculari fusco-punctulata, ovario rhachi subimpresso oblongo apice obtuso et oblique stigmatifero.

In provincia Larecaja, viciniis Ananea cerro de Tuiki in dumetosis, alt. 3150 m., Maio (Mandon, no. 1117 in Herb. Mus. Par.).

Herba erecta, caulibus ramulosis in sicco coriaceis circiter 4 mm. crassis et junioribus dense pilosis, internodiis circiter 6 mm. longis. Limbi ad 3.5 cm. longi et ad 22 mm. lati, in sicco firmi et opaci. Petioli 5 mm. longi pedunculique eis paulo longiores hirtelli. Amenta in sicco fusco-punctulata densiflora. Stigma carnosum puberulumque.

10. P. BREVISPICA, foliis supra adpresse puberulis subtus glabris et fusco-punctulatis inferioribus majoribus longe petiolatis e basi cuneata obovato-ellipticis apice obtusis 7-plinervis superioribus gradatim minoribus, amentis in apice ramulorum axillaribus terminalibusque quam folia inferiora pluries brevioribus longiuscule pedunculatis et densifloris, bractea orbiculari, ovario emerso obovato sub apice oblique stigmatifero.

Bang, no. 2641.

Herba erecta ramulosa, ramulis glabris coriaceis. Limbi in sicco rigido-membranacei subpellucidi crebre pellucido-punctulati foliorum inferiorum 4 cm. longi et 27 mm. lati cum petiolis 2 cm. longi, superiorum multo minores an adulti? Pedunculi 5 mm. longi. Amenta 9 mm. longa. Antherae ellipticae quam filamenta paullo breviores. Stigma papillosulum.

†† *Ovarium apice oblique complanatum et scutatim auctum, antice stigmatiferum. Bacca oblique rostrata.*

11. P. PELTIFOLIA, foliis magnis longe petiolatis ample ovatis fere ad 4 cm. supra basin peltatis basi rotundatis vel leviter repandis apice breviter acuminatis supra sat dense et adgresse pilosis subtus densissime villosis, nervo centrali fere ad ⅔ longitudinis nervos utrinque 5 adscendentes supra basin et 2–3 e basi divaricantes mittente, amentis in apice caulis oppositifoliis quam folia brevioribus, pedunculis quam petioli brevioribus et dense villosis, rhachi adulta dense villosa, bractea orbiculari, ovario emerso ovato apice oblique rostrato et antice complanato sub rostro stigma carnosum gerente.

In Bolivia (Rusby, sine numero in Herb. Columbia University).

Caulis dense villosus circiter 6 mm. crassus. Limbi in sicco membranacei, circiter 24.5 cm. longi et 14.5 cm. lati. Petioli ad 11 cm. longi. Pedunculi adulti circiter 3 cm. longi. Amenta ut videtur adulta 6–7 cm. longa et 6 mm. crassa.

12. P. COBANA C. DC. Bot. Gaz. **19**: 260. 1894.

In Bolivia (Rusby, sine num. in Herb. Columbia University).

** *Folia opposita.*

13. P. CIRCINATA Link, Jahrb. 1[3]: 64. 1820.

Ad confluentem fluminum Beni et Madre de Dios (Rusby, no. 2208 in Herb. Columbia University).

14. P. BLANDA Kunth, H.B.K. Nov. Gen. 1: 67.

In Bolivia (Rusby, no. 1819[b] in Herb. Columbia University).

*** *Folia verticillata.*

15. P. MULTISPICA, foliis 4–3-verticillatis brevissime petiolatis utrinque hirtellis margineque ciliatis e basi acuta inferioribus minoribus obovatis superioribus vero lanceolatis 3-nerviis, amentis axillaribus terminalibusque in apice caulis numerosis et filiformibus folia fere 4-plo superantibus longiuscule pedunculatis, bractea orbiculari, ovario emerso apice oblique stigmatifero, bacca subglobosa laevi et glabra.

In Bolivia (Rusby, no. 331 in Herb. Cand.; Bang, no. 2639 in Herb. Columbia University).

Erecta inferne radicans, circiter 20 cm. alta, caule dense hirsuto in sicco 3 mm. crasso. Limbi superiores ad 22 mm. longi vix 1 cm. lati. Petioli ad 2.5 mm. longi. Amenta haud densiflora. Stigma minutum.

Species *P. camptotrichae* Miq. proxima.

16. P. SAXICOLA, foliis 3–5-verticillatis brevissime petiolatis superioribus ellipticis basi acutis apice obtusiusculis utrinque adpresse et dense pilosulis 3-nerviis, amentis axillaribus terminalibusque pedunculatis, filiformibus folia parum superantibus, bractea rotundato-elliptica, ovario emerso obovato glandulis consperso apice stigma minutum glabrum oblique gerente, bacca elliptica laevi apice brevissime oblique acutata.

17. P. STUBELII C. DC. Bull. Torr. Bot. Club, 19: 255. 1892.

Tunari (Otto Kuntze), San Pedro in rupibus (Herb. Mus. Par.).

18. P. INAEQUALIFOLIA R. et Pav. Fl. Per. 1: 30. *pl. 46, a.*

In provincia Larecaja, alt., 269 m., Augusto (Mandon, no. 1120 *bis* in Herb. Mus. Par.).

19. P. GALIOIDES Kunth, H.B.K. Nov. Gen. 1: 71.

In provincia Larecaja, viciniis Sorata, carro del Iminapi in umbrosis (Mandon, no. 1119 in Herb. Mus. Par.).

In provincia Larecaja viciniis Sorata prope Challapampa in petrosis, Decembri (Mandon, no. 1118 in Herb. Mus. Par.).

Herba caule dense et depresse pilosulo inferne radicante superne ramuloso, in sicco circiter 4 mm. crasso. Folia inferiora obovata,

superiorum limbi in sicco membranacei subopaci ad 2 cm. longi et 7 mm. lati. Petioli vix 2 mm. longi. Pedunculi pilosuli circiter 12 mm. longi.

20. P. ACEROANA, glabra foliis plerumque 4-verticillatis breviter petiolatis e basi acuta oblongo-obovatis vel oblongo-ellipticis in sicco subcoriaceis, amentis terminalibus longe pedunculatis ipsis folia circiter duplo superantibus filiformibus densifloris, bractea orbiculari, ovario emerso oblongo, summo apice stigma carnosum glabrum gerente.

In provincia Acero, Novembri et Decembri (Weddel, no. 3615 in Herb. Mus. Par.).

Herba repens, ramuli erecti cum amentis circiter 6 cm. longi in sicco coriacei 1 mm. crassi. Petioli vix 3 mm. longi. Pedunculi circiter 3 cm. longi.

Species rhachi glabra a *P. reflexa* Diet. ovariis haud immersis limbis angustioribus ramulisque glabris a *P. Boliviensi* C. DC. discrepans.

21. P. TOMINANA, foliis parvis plerumque quaternis brevissime petiolatis ellipticis basi et apice obtusis utrinque glabris apice ciliolatis, nervis inconspicuis, amentis terminalibus longiuscule pedunculatis ipsis folia circiter duplo superantibus densifloris et filiformibus, rhachi hirtella, bractea orbiculari, ovario emerso oblongo summo apice stigma carnosum et glabrum gerente.

In prov. Tomina, Depart. Chuquisata, Decembri (Weddel, no. 3109 in Herb. Mus. Par.).

Herba e basi radicante ramulis hirtellis 4–5 cm. longis in sicco coriaceis 1 mm. crassis. Limbi in sicco coriacei subpellucidi adspectu enervii 6 mm. longi. Petioli 1 mm. longi. Pedunculi hirtelli circiter 1 cm. longi. Amenta florentia circiter 12 mm. longa.

Species *P. reflexae* Diet. proxima foliis multo minoribus ovarioque emerso ab ea discrepans.

22. P. PSILOSTACHYA C. DC. Mem. Soc. Phys. **32**: *pl. 54. f. 6.*

In prov. Yungas, alt. 6000 ped. (Rusby, no. 2210 in Herb. Columbia University).

23. P. REFLEXA Diet. Sp. **1**: 180.

In prov. Yungas, alt. 6000 ped. (Rusby, no. 2203 in Herb. Columbia University).

Starch Distribution as affected by Fungi.*

By Byron D. Halsted.

A study of the distribution of starch in variegated leaves led to a consideration of the presence of this carbohydrate in leaves that were more or less affected with parasitic fungi. Thus, from the variegated *Abutilon* and *Ficus* leaves it was an easy step to those that were mottled by the presence of fungi.

The treatment consisted in immersing the leaves in weak alcohol in glass vessels which stood in the full light of the sun.

The time required for the removal of the chlorophyll depends much upon the thickness and density of the leaf and whether it was freshly gathered or a dried specimen. Usually two or three days are sufficient for the blanching of the leaf when it is ready to be placed in a weak solution of iodine made by adding an ounce of the ordinary solution of iodine in iodide of potassium to a pint of water.

After remaining for a few hours there may be some changes expected, the thinner the leaf the more rapid the reaction. The starch in the leaf responds to the iodine test and, turning blue, brings out the locality where the starch is present in the leaf.

The first subject to be tested chanced to be some dried leaflets of *Potentilla Monspeliensis* affected with the *Peronospora potentillae* DeBy., which, somewhat to my surprise, became quite distinctly blue at the areas where the fungus was bearing its conidia.

This fungus produces angular patches of a brownish color, easily seen from the upper side, while below the surface of the spots become covered with the conidiophores and conidia of the fungus giving this side of the leaf a mildewy appearance in small patches with irregular outlines.

In this instance the leaflets were first placed in 50 per cent. alcohol in a large culture jar with glass cover and set in the sun. After the green has been removed the leaves were transferred to another culture jar containing the iodine and kept in the dark.

* Read before Section G, A. A. A. S., at Boston, August 23, 1898.

In the course of twenty-four hours the portion of the bleached leaflets containing starch were indicated by a darker tinge than elsewhere. A longer exposure to the iodine brought out the starch so that it was located distinctly, and it was found that, with the specimens employed, the starch was confined almost exclusively to the mildewed patches and the neighboring small angular areas that adjoin the portions that already showed the *Peronospora*.

The darkening at these diseased patches was sufficient so that a sun print was taken of a leaflet and afterwards enlarged to five times its natural size, as was shown in a photograph. The original picture was made by placing the leaf directly against the sensitized plate so that every detail is exactly as in the leaf, both as to size and position of all parts.

It is to be remembered that the blanching was not complete, and the iodine, while coloring the starch blue, also tinged the other portions of the tissue of that peculiar "dirty yellow" that is always the bane of the photographer. In short, the picture in this instance, as in all others, is only a faint record of what may be seen when looking at the treated specimen.

One of the most interesting of the observations made under the subject in hand was with *Synchytrium decipiens* Farl. in the leaves of hog-peanut, *Falcata comosa* (L.) Kuntze.

It will be remembered that the Chytridiaceae to which our subject belongs is without hyphae and, therefore, the locality of the fungus is easily determined by that of the infested cells. The leaflets of this host are thin and the iodine easily penetrates the tissue and for the same reason the starch, even when in small amounts, can be distinctly seen.

In the dozen or so of leaves examined it was found that the starch is located immediately around the spore cysts and extends from it through usually one mesh or irregular area made by the ultimate ramifications of the vascular framework. As a matter of fact the fungus is generally located along the lateral veins of the leaf and these are brought out as irregular blue lines when the leaves have been subjected to the iodine test. When a leaflet is quite badly diseased with the *Synchytrium* it will take a blue color throughout all its tissues.

A leaf of *Amarantus retroflexus* L., having seven large circular

patches of *Cystopus bliti* (Biv.) each nearly a third of an inch in diameter was placed in the iodine solution without the previous bleaching, when, after a week, it was found that practically no starch was in the pustular portion, but close around the diseased area was a deep blue circle. All the healthy portion of the leaf contained starch in considerable quantity, but the large amounts in the tissue immediately bordering the portion bearing the conidia of the fungus were in striking contrast with all other parts.

The most striking subject among the leaf parasites is the mandrake leaf infested with *Puccinia podophylli* Schw. It is interesting for the very large amounts of starch that are located in the infested areas, and also for the sharp line of demarcation between the diseased and the healthy portions of the leaf. In other words the *Puccinia* seems to find the ultimate ramifications of the vascular system a complete barrier to its lateral growth, and it seems that the infection in many instances is local and does not reach beyond the angular boundaries made by the smaller veins. The same lines become the enclosures for the starch-bearing areas.

It will also be seen here that the infested areas bear some relationship to the main veins in this, that one side at least of nearly every infested area is against a vein of considerable size, a subject that is a study in itself.

Another fact is noticed in the mandrake, namely, that as a rule there is less starch in the center of the rusted mesh than nearer the periphery.

One of the most striking instances of starch localization is found in the leaves of ordinary corn that are infested with the smut (*Ustilago maydis* DC.). Pieces of leaves that were more or less distorted by nodules and projections of the smut-bearing tissue that had been in alcohol for a year as material for class study of the smut were placed in the iodine, when the blue color began almost immediately to appear in the swollen tissue. All of the bullate portions of the leaves due to the infestation of the fungus finally became of a strong blue color.

A study of the subject with the hand lens showed that, while there was an abundance of starch in the warts, around each center there was a very small space free from starch followed by the

ordinary leaf tissue strongly discolored by the iodine. It was also seen with the lens that the blue color was not uniformly distributed, but in very narrow lines running parallel with the midrib and corresponding with the smaller vascular strands in the leaf.

If we turn now from the consideration of leaves infested with fungi to stems that are similarly attacked the same rule obtains. For example, some hypertrophied flower stalks of cultivated radish that were in stock in formalin as student's material were thinly sectioned and placed in a weak solution of iodine, when, within a minute, the characteristic bluish tinge came into the sections. Similar thin sections were made of the same stems, but at places where no swelling or distortion had taken place and these showed but the smallest amount of starch and that was usually in a single ring of cells located just outside of the bast. As the bast is not continuous the starch-bearing sheath so-to-say was likewise irregular and bent inward at the intervals between the bast stands. There was practically no starch inside of this thin layer, but a small amount outside of it.

In the infested stems the starch is very abundant and in largest amounts in the parenchyma, lying between the wedge-shaped bundles and extending from them throughout the pith. Beside this there is the starch-bearing layer above mentioned, but outside of it there is no starch. The distribution of the oöspores does not seem to bear any relation to that of the starch.

A similar condition of things was met with in the hypertrophied stems (*Exoascus* sp.) of the wild goose plum (*Prunus hortulana* Bailey) when compared with the normal parts of the same twigs.

The galls of the peach roots are simply gorged with starch, and thin sections of them turn to a dark blue color. This color may be brought out by cutting the knot through the middle and shaving the surface smooth and applying iodine. Certain irregular layers and folds will be darker than others, showing that the starch is distributed most abundantly around the wood proper and not in it.

An interesting study in this direction was made of the cedar galls of *Gymnosporangium macropus* Lk., where the starch is packed away in the enlarged host cells to their utmost capacity, and thin sections through the centers of large galls display a neat fan-shaped

appearance after they have been in iodine for a few minutes. The ordinary wood of the gall-bearing twigs show with the same treatment only a small amount of starch, not enough to appear even bluish to the eye after being treated with iodine.

There are certain species of fungi that cause an upright growth of the host when normally the stems are prostrate or reclined. The purslane plants affected with *Cystopus portulacae* (DC.) are a case in point. An examination has been made of the upright, usually dwarfed and badly infested stems of the *Portulaca oleracea* as compared with similar portions of the healthy and prostrate branches. In the latter it is noted that there is much more pink coloring in the sap of the epidermal cells of the upper than the lower side and a larger amount of chlorophyll in the exposed than in the shaded half of the stems as they lie upon the ground. The wood zone is much nearer the outside upon the upper than the lower half of the stem, but there seems to be no marked difference in the wood zone itself, which is circular or oval in outline, consisting of a broken ring of 15 to 20 vascular bundles.

In the healthy stem, while the starch is scattered somewhat, it is confined quite closely to a thin layer of small cells just outside of the ring of wood. The upright mildewed stems have less chlorophyll present, but aside from this the most noticeable difference is the fact that the starch zone is indistinct, the granules being distributed in the cells of the parenchyma both within and outside the starch-bearing sheath so distinctly differentiated in the healthy stem.

In sections made of turnips suffering from the club root fungus, *Plasmodiophora brassicae* Wor., it was quickly observed that the diseased portions were quite generally starch-bearing. Thin sections treated with iodine demonstrated to the eye and the compound microscope that the main portion of the starch is contained in the cells infested with the slime mould. Sections of the same turnip taken in its healthy portions showed but a minimum of starch and this is located in the cells of the cortex. In short, where large slices of the healthy and diseased tissue were laid in weak iodine in a porcelain dish the former showed little or no starch, while the diseased portions appeared almost black.

Thin sections of the large tubercles formed by *Rhizobium*

leguminosarum Fk., were laid in the iodine solution along with those from the roots near by and bearing the galls. The tissue of the tubercles turned blue almost immediately, while the slices of the roots themselves gave only the faintest indications of starch. The tubercle has a layer of loose cellular tissue as a covering inside of which is the denser substance abounding in the bacterioids. It is this covering that is gorged with starch and from it and reaching in towards the center of the gall are irregular anastomosing broad lines, also containing starch.

Plants that are victims to parasitic fungi may possibly be influenced as if they were wounded. Richards, in his extended experiments upon the respiration of wounded plants,* has concluded that there is an increased respiration after an injury to plant tissue, varying in amount and duration with the character of tissue and extent of wound. "This increased respiration," to quote Dr. Richards' words, "may be ascribed to an effort on the part of the plant to recover from the injury by which the ordinary functions of the plants are stimulated, thereby demanding and necessitating an increased supply of oxygen." Bohn, † referred to by Richards, "concludes there is no doubt that the cause of it (respiration) is alone the irritation of the wound itself and not the increased opportunity for the action of the oxygen of the air." But Richards' experiments and those of Stich, whose paper in Flora has not been consulted, show "that the oxygen of the air plays an important part in the reaction of the respiratory function of the plant toward injury."

Townsend ‡ in his extensive studies states that slight injuries accelerate the rate of growth and will continue for several days. He states, "The change in the rate of growth of higher plants under the influence of a single irritation begins gradually, reaches its maximum in from twelve to ninety-six hours and gradually diminishes until the normal rate is resumed." Also "The influence of an irritation due to cutting or other injury is capable of acting through a distance of several hundred millimeters."

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* Annals of Botany, **10**: 531–582. D. 1896.

† Ueber die Respiration der Kartoffel. Bot. Zeitung, **45**: 671. 1887.

‡ The Correlation of Growth under the Influence of Injuries. Annals of Botany, **11**: 509–532. D. 1897.

It is not the purpose, however, of this paper to do more than call attention to the distribution of starch as affected by parasitic fungi. The infesting fungus induces a change in the surrounding tissue, more or less apparent, with the storage therein of food material as shown by the starch test and demonstrated in the instances noted above.

RUTGERS COLLEGE.

New and interesting Plants from Western North America.—III.*

By A. A. Heller.

Salix Lyallii (Sargent)

Salix lasiandra, var. *Lyallii* Sargent, Gard. & Forest **8**: 463. 1895.

This species is abundant in the low ground along the Chehalis river, in Chehalis county, Wash. I have collected what is said to be *Salix lasiandra* near Lewiston, Idaho, and the variety *caudata* at the original station near Santa Fé, New Mexico, and this western Washington plant is very different from both. As described in the "Silva," it certainly has sufficient characters to make it worthy of specific rank, for it is said to differ in its "longer leaves, tapering from the rounded or subcordate base, usually white on the lower surface, and often seven or eight inches in length, in its more glandular petioles, and the rather narrower and less hairy scales of the pistillate aments."

Corylus Californica (A. DC.)

Corylus rostrata β Californica A. DC. Prodr. **16**^{2}: 133. 1864.

This differs from the eastern *Corylus rostrata* in its shorter, rounder, thinner, and more pubescent leaves. The tube of the involucre is also much shorter and broader, sometimes barely exceeding the nut. It is abundant in grassy clearings about Montesano, Chehalis county, Washington, occurring as a shrub four to six feet in height, and growing in clumps.

Ranunculus intermedius (Hook.)

Ranunculus Flammula β intermedia Hook. Fl. Bor. Am. **1**: 11. 1830.

Hooker describes this as "caule repente gracili foliis anguste lanceolatis superioribus linearibus integerrimus. * * On the gravelly banks of rivers from Canada to lat. 69°." This is one of several varieties described by him, but he says that none of them appear to grow west of the Rocky mountains. As now interpreted, this form occurs also on the Pacific slope, but the west coast forms are more robust than the eastern specimens. In his "Flora of North-

*Substituted for the improper title: "New Plants from Western North America."

west America," Mr. Howell takes for this plant the name *R. Unalaschensis* Bess., published in 1842, founded upon specimens from Alaska, but cites Hooker's name as a synonym. I have seen no Alaskan specimens, and there is a possibility that the eastern and western forms may prove distinct.

Our specimens were collected near Montesano, Washington, June 11, 1898. The plant is plentiful in wet places, the decumbent and creeping stems often two feet long, the lower leaves over a half inch in width.

OPULASTER PAUCIFLORUS (Nutt.)

Spiraea pauciflora Nutt.; T. & G., Fl. N. A. **1**: 414. 1840.
Spiraea opulifolia γ pauciflora T. & G., Fl. N. A. **1**: 414. 1840.
Neillia malvacea Greene, Pittonia, **2**: 30. 1889.
Opulaster malvaceus Kuntze, Rev. Gen. Pl. 949. 1891.

Nuttall's type, which is in the herbarium of Columbia University, was collected in "glades of the Blue Mts., Columbia." It is abundant on the Craig mountain plateau, Idaho, which is separated from the Blue mountains by the Snake river, also on the Palouse hills on the north side of the Clearwater, and across the country along the mountains to Lake Pend d'Oreille, where Professor Greene collected his type of *Neillia malvacea*. It is apparently the only *Opulaster* in that region, as its near relative *O. monogynus* has not been detected outside of the Rocky Mountains, and *O. capitatus* appears to be restricted to the western side of the Cascades.

KALMIA MICROPHYLLA (Hook.)

Kalmia glauca γ microphylla Hook. Fl. Bor. Am. **2**: 41. 1834.

The original of this was collected in "swamps in the Rocky Mountains, *Drummond*," and is described as having "foliis vix semipollicaribus subovalibus." I have seen a number of specimens of this from the Rocky Mountains, and consider them entirely distinct from *Kalmia glauca*, with its narrower, longer and thicker leaves.

STACHYS PUBENS (A. Gray)

Stachys ciliata, var. *pubens* A. Gray, Syn. Fl. N. A. **2**[1]: 388. 1878.

This is described as having "flowers commonly rather smaller

or shorter" than those of *S. ciliata*. Our specimens, collected at Montesano, Washington, have flowers much larger, and red-purple in color, as compared with the pink flowers of *S. ciliata*, which is also plentiful at the same place. The plant in the Columbia herbarium, collected by Holmes on the Fraser river, and cited as the type of the variety, is imperfect, and the flower appears to be rather small. This appearance, however, is probably due to insufficient pressure, for in other respects our plant is similar, as are specimens collected by Macoun in British Columbia. In addition to the larger, darker colored flowers, this species is much stouter than *S. ciliaris*, blooms two weeks later, has narrower leaves in proportion to their length, with sharper crenations, and the inflorescence is longer, with shorter and narrower floral leaves.

HYDROPHYLLUM TENUIPES sp. nov.

Stems erect, rather stout, about 5 dm. high, branching, purplish, especially below, channeled, sparingly covered with spreading, clear colored hairs: leaves broadly ovate in outline, the larger lower ones about 10 cm. in length by 15 cm. in width, lower and basal ones long-stalked, pinnately 3–5-parted, the lobes obovate, and laciniately toothed or cut, the teeth acute, mucronate; both sides more or less provided with hairs of the same character as those of the stem, but appressed; the under side also slightly whitened: cymes on stalks about 8 cm. in length, simple or forked, the flowers borne on slender pedicels .5–1.5 cm. in length, which are beset with the same kind of hairs which are on the other parts of the plant: calyx 7–8 mm. long, the lobes erect, narrowly linear-lanceolate, hispid-ciliate with the same clear spine-like hairs: flowers creamy, or faintly tinged with purple, the corolla-lobes almost oval in outline, a little longer than the calyx, slightly notched, with an oblong appendage half as long as the lobe attached to the inner face of each: stamens long-exserted, as in the genus: ovary hispid.

The type is our no. 3853, collected at Montesano, Chehalis county, Washington, May 31, 1898. The plants grew in low, moist, rich ground, along the Chehalis river, in a place which later in the season becomes overgrown with grass, small bushes, and various herbaceous species. *Hydrophyllum tenuipes* belongs to the medley called *Hydrophyllum occidentale*, but differs from typical plants of that species by its acute leaf-segments, possibly taller growth, and the totally different character of its pubescence.

411 W. WALNUT STREET, LANCASTER, PA.

Cordyceps stylophora Berk. & Br. in Minnesota.

On the 28th of April, 1898, I found a single specimen of this rare American species growing upon the larva of a carabid beetle among *Hypnum* at Minnehaha Falls near Minneapolis. The plant was originally described from specimens of Ravenel collected in South Carolina and was distributed by Ravenel in Fung. Car. Exsic. **5**: no. 49. It is figured in Berkeley's paper,* but the ripe asci were not seen by the authors. Another figure of the plant is given by Massee † in his monograph of the genus, and in this paper the first measurements of asci and spores are recorded from the type specimen in the Kew Herbarium. I do not find that the Minnesota plant conforms exactly to these measurements. According to Massee the spores are 125–135 × 1 μ and the component cells "about 3.5 μ long." The Minnesota plant shows spores 150–180 × 2 μ with component cells 6–7 μ long. In all other respects the plant found at Minnehaha agrees quite exactly with the descriptions and figures. In Saccardo ‡ and Ellis § no microscopic measurements are given. This new discovery is apparently indicative of a comparatively wide range for the species.

CONWAY MACMILLAN.

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* Berkeley. On some entomogenous Sphaeriae. Journ. Linn. Soc. **1**: 157–159. *pl. 1. f. 3.* 1857.

† Massee. A Revision of the Genus *Cordyceps*. Ann. of Bot. **9**: 1–44. *pl. 2. f. 40, 41.* Mr. 1895.

‡ Saccardo. Syll. Fung. **2**: 568. 1883.

§ Ellis and Everhardt. N. Am. Pyren. 61. 1892.

Index to recent Literature relating to American Botany.

Arthur, J. C. Water Power for Botanical Apparatus. Proc. Ind. Acad. Sci. **1897**: 156–157. 1898.

Beal, W. J. Stems pierced by Rootstocks. Asa Gray Bull. **6**: 69, 70, *f. 12*. Au. 1898.

Beal, W. J. Report of the Botanical Department of the State Agricultural College. Rep. Mich. State Board Agric. **1897**: 47–59. 1898.

Beattie, R. K. Nebraska Ferns and Fern Allies. Fern Bull. **6**: 72–74. O. 1898.

Belajeff, W. Ueber die Cilienbildner in den spermatogonen Zellen. Ber. Deutsch. Bot. Ges. **16**: 140–144. *pl. 7*. 22 Je. 1898.

Bentley, H. L. A Report upon the Grasses and forage Plants of Central Texas. Bull. U. S. Depart. Agric. (Div. Agrost.) **10**: 1–38. *f. 1–14*. 1898.

Bessey, C. E. Twelfth Annual Report of the Botanist of the Nebraska State Board of Agriculture. Ann. Rep. Neb. State Board Agric. **1897**. 107–140. 1898.

Bessey, C. E. The southern Maidenhair Fern in the Black Hills of South Dakota. Bot. Gaz. **26**: 211. 17 S. 1898.

Bitting, A. W. The Number of Micro-organisms in Air, Water and Milk as determined by their Growth upon different Media. Proc. Ind. Acad. Sci. **1897**: 143–148. 1898.

Blasdale, W. C. Seed Production. Asa Gray Bull. **6**: 65, 66. Au. 1898.

Discusses number and weight of seed produced on different flowers of same plant.

Borgesen, F. & Paulsen, O. Om Vegetationen paa de dansk-vestindiske Oer. Bot. Tidssk. **22**: 1–130. *pl. 1–11*. 1898.

Boudier, M. Sur deux nouvelles espèces d' Ascobolés et observations sur l' Urnula Craterium récemment découvert en France. Bull. Soc. Myc. de France, **14**: 125–129. *pl. 11*. 31 Au. 1898.

Britten, J. Smith's Georgian Plants. Jour. Bot. **36**: 297–302. Au. 1898.

Britten, J. The Nomenclature of some *Senecios*. Jour. Bot. **36**: 259, 260. Jl. 1898.

Britten, J. Bibliographical Notes.—XV. Gronovius's "Flora Virginica." Jour. Bot. **36**: 264–267. Jl. 1898.

Britton, E. G., Collins, J. F., and **G[rout], A. J.** Microscopic Preparations of Mosses. Fern Bull. **6**: 89–91. O. 1898.

Buscalioni, L., & Casagrandi, O. Sul Saccharomyces guttulatus (Rob.) Nuovi osservazioni. Malpighia **12**: 59–75. *pl. 1.* 1898.

Campbell, D. H. On the Structure and Development of *Dendroceros* Nees. Jour. Linn. Soc. **33**: 467–478. *pl. 21, 22.* 1 Jl. 1898.

Chesnut, V. K. Principal poisonous Plants of the United States. Bull. U. S. Dept. Agric. (Div. Bot.) **20**: 1–60. *f. 1–34.* 1898.

Chodat, R., & Boubier, A. M. Sur la plasmolyse et la membrane plasmique. Jour. de Bot. **12**: 118–131. *pl. 1.* 16 Ap. 1898.

Cole, E. J. Cleistogamous Flowers on *Solea concolor.* Asa Gray Bull. **6**: 50. Je. 1898.

Coulter, J. M. The Origin of the Gymnosperms and the Seed Habit. Bot. Gaz. **26**: 153–168. 17 S. 1898.
Address of retiring president of Botanical Society of America.

Coulter, S. Contributions to the Flora of Indiana, no. 5. Proc. Ind. Acad. Sci. **1897**: 158–168. 1898.

Coulter, S. Experiments in Germination of Composites. Proc. Ind. Acad. Sci. **1897**: 165, 166. 1898.

Coupin, H. Sur la toxicité du chlorure de sodium et de l'eau de mer, a l'egard des végétaux. Rev. Gen. de Bot. **10**: 177–190. 15 My. 1898. [Illust.]

Coville, F. V. Forest Growth and Sheep Grazing in the Cascade Mountains of Oregon. Bull. U. S. Depart. Agric. (Div. Forestry), **15**: 1–53. 1898.

Cunningham, A. M. Indiana's Gentianaceae. Proc. Ind. Acad. Sci. **1897**: 168–170. 1898.

Cunningham, A. M. The Ericaceae of Indiana. Proc. Ind. Acad. Sci. **1897**: 166–168. 1898.

Dassonville, C. Influence des sels mineraux sur la forme et la structure des vegetaux. Rev. Gen. de Bot. **10**: 15–25. 15 Ja. 1898; 59–68. 15 F. 1898; 102–124. 15 Mr. 1898; 161–170. 15 Ap. 1898; 193–199. 15 My. 1898; 238–260. 15 Je. 1898; 289–304. 15 Jl. 1898; 335–344. 15 Au. 1898; 370–377. *pl. 5–14.* 15 S. 1898.

Davis, J. J. Second supplementary List of Parasitic Fungi of Wisconsin. Trans. Wis. Acad. Sci. **11**: 165–178. 1898.

Davy, J. B. *Scirpus maritimus compactus* Koch. Erythea, **6**: 92. 22 S. 1898.

Davy, J. B. Parasitism of *Orthocarpus pusillus* Benth. Erythea, **6**: 93. 22 S. 1898.

Deane, W. Inflorescence of *Clintonia borealis*. Asa Gray Bull. 6: 41–44. *f. 10.* Je. 1898.

Denniston, R. H. The comparative Structure of the Barks of certain American *Viburnums*. Pharm. Archives **1**: 137–148. *pl. 7–14.* Jl. 1898.

Dietel, P. Bemerkungen zu der Uredineenflora Mexicos. Hedwigia, **37**: 204–211. 20 Jl. 1898.

Puccinia abrupta D. & H. sp. nov.

Dodge, C. R. Flax Culture for Seed and Fiber in Europe and America. Rep. Office Fiber Invest. U. S. Depart. Agric. **10**: 1–80. *pl. 1–4.* 1898.

Discusses briefly the botanical relationships of *Linum usitatissimum*.

Du Bois, C. G., White, T. G., & Clendenin, I. Plant Vitality. Asa Gray Bull. **6**: 70, 71. Au. 1898.

Notes on vitality of *Cotyledon, S dum* and *Selaginella lepidophylla*.

Eastwood, A. *Pyrola minor* L. in California. Erythea, **6**: 93. 22 S. 1898.

Eastwood, A. Studies in the Herbarium and the Field.—No. 2. Proc. Cal. Acad. Sci. III. **1**: 89–146. *pl. 8–11.* 5 S. 1898.

New species in *Abronia, Astragalus, Hosackia, Peucedanum, Amsinckia, Lycium, Plantago, Malacothrix, Cnicus, Synthyris, Eriodictyon, Campanula, Romneya, Sedum, Cercocarpus* and *Calochortus*.

Farlow, W. G. The Conception of Species as affected by recent Investigations on Fungi. Am. Nat. **32**: 675–696. S. 1898.

Fernald, M. L. The Genus *Antennaria* in New England. Proc. Boston Soc. Nat. Hist. **28**: 237–249. Je. 1898.

Recognizes six species and several varieties.

Fernow, B. E. Forestry Conditions and Interests of Wisconsin. Bull. U. S. Depart. Agric. (Div. Forestry), **16**: 1–76. *pl. 1.* 1898.

Ferris, C. G. Micro-organisms in Flour. Proc. Ind. Acad. Sci. 1897: 137–143. 1898.

Fuchs, P. C. A. Untersuchungen über den Bau der Raphidenzelle. Osterr. Bot. Zeitsch. **48**: 324–339. *pl. 9.* S. 1898.

Ganong, W. F. On halophytic Colonies in the Interior of New Brunswick. Bull. Nat. Hist. Soc. N. B. **16**: 50–52. 1898.

Graves, F. M., DuBois, C. G., & McDonald, W. H. Albino Flowers. Asa Gray Bull. **6**: 48, 49. Je. 1898.

Greene, E. L. A Fascicle of new Labiatae. Pittonia, **3**: 338–343. 24 S. 1898.

New species in *Hedeoma*, *Lycopus* and *Stachys*.

Greene, E. L. New and Noteworthy Species.—XIX. Pittonia, **3**: 212–230. 25 S. 1897;—XX. 246–252. 9 D. 1897;—XXI. 257–263. 25 F. 1898;—XXII. 306–311. 8 Ap. 1898;—XXIII. 343–349. 24 S. 1898.

New species in *Hedysarum*, *Trifolium*, *Astragalus*, *Cassia*, *Streptanthus*, *Hieracium*, *Apocynum*, *Thelypodium*, *Papaver*, *Potentilla*, *Aster*, *Hymenopappus*, *Senecio*, *Vaccinium*, *Primula*, *Delphinium*, *Myosurus*, *Viola*, *Mertensia*, *Plagiobotrys*, *Lithospermum*, *Arabis*, *Draba*, *Polygala*, *Lupinus*, *Verbena*, *Gentiana*, *Penstemon*, *Ptiloria*, *Saxifraga*, *Abronia*, *Amarantus*, *Argemone*, *Cakile*, *Antennaria*, *Pyrrocoma*, and *Solidago*.

Greene, E. L. Some Canadian Violets. Pittonia, **3**: 333–338. 24 S. 1898.

V. septentrionalis, *V. Macounii*, *V. venustula* and *V. populifolia*, new species.

Grevillius, A. Y. Ueber den morphologischen Werth der Brutorgane bei *Aulacomnium androgynum* (L.) Schwaegr. Ber. Deutsch. Bot. Ges. **16**: 111–117. *pl. 6.* 25 My. 1898.

Grout, A. J. The Dicranums. Fern Bull. **6**: 86–89. *f. 1–9.* O. 1898.

Groves, H. & J. On Characeae collected by Mr. T. B. Blow, F.L.S., in the West Indies. Jour. Linn. Soc. **33**: 323–326. *pl. 19.* 1 Jl. 1898.

Nitella dictyosperma sp. nov.

Grüss, J. Ueber Oxydasen und die Guajareaction. Ber. Deutsch. Bot. Ges. **16**: 129–139. 22 Je. 1898.

Harrison, F. C. Bacterial Content of Hailstones. Bot. Gaz. **26**: 211–214. 17 S. 1895.

Two new varieties, *Bacillus flavus grandinis* and *Micrococcus melleus grandinis*.

Harshberger, J. W. Abnormal Flowers of *Verbesina*. Asa Gray Bull. **6**: 67–69. Au. 1898.

Heald, F. D. A Study of Regeneration as exhibited by Mosses. Bot. Gaz. **26**: 169–210. *pl. 19, 20.* 17 S. 1898.

Heeg, M. Mittheilungen über einige Arten der Gattung *Riccia*. Bot. Not. **1898**: 15–24; 107–116. 1898.

Heese, E., & Schumann, K. Ueber die Heimat von *Cereus grandiflorus* und *C. nycticalus*. Monatsschr. für Kacteenkunde, **8**: 76, 77. 15 My. 1898.

Jenman, G. S. Ferns of British West Indies and Guiana. Bull. Royal Bot. Gard. (Trinidad) **3**: 4–32. Ja. 1898.

Descriptions of Hymenophyllaceae; new species in *Hymenophyllum* and *Trichomanes*.

Jenman, G. S. The Fern and Fern Allies of the British West Indies and Guiana. Bull. Roy. Bot. Gard. (Trinidad), **3**: v–ix, 33–60. Jl. 1898.

Conspectus of genera and descriptions of Cyatheaceae. *Hemitelia Trinitensis*, *Cyathea caribaea*, *C. Purdiaei*, and *C. moniliforme* sp. nov.

Johnson, D. S. On the Development of the Leaf and Sporocarp in *Marsilia quadrifolia* L. Ann. Bot. **12**: 119–145. *pl. 10–12*. Je. 1898.

Jones, H. L. A new species of Pyrenomycete parasitic on an Alga. Bull. Oberlin Coll. Lab. **9**: 3. 15 Je. 1898.

Sphaerella chondri sp. nov.

Jones, H. L. List of Ohio Plants not recorded in the latest state Catalogue. Bull. Oberlin Coll. Lab. **9**: 4–8. 15 Je. 1898.

Jones, H. L. Unusual Forms of Maple Seedlings. Bull. Oberlin Coll. Lab. **9**: 9. 15 Je. 1898. [Illust.]

Kamerling, L. Der Bewegungsmechanismus der Lebermooselateren. Flora, **85**: 157–169. 9 Au. 1898.

Kearney, T. H., Jr. A Revision of the North American Species of *Calamagrostis*. Bull. U. S. Depart. Agric. (Div. Agrost.) **11**: 7–42. *f. 1*. 1898.

11 new species and 11 new varieties.

Keffer, C. A. Experimental Tree Planting in the Plains. Bull. U. S. Depart. Agric. (Div. Forestry), **18**: 1–94. *pl. 1–5*. 1898.

Kuckuck, P. Ueber die Paarung von Schwärmsporen bei *Scytosiphon*. Ber. Deutsch. Bot. Ges. **16**: 35–37. 27 Ap. 1898. [Illust.]

Küster, E. Zur Analogie und Biologie der adriatischen Codiaceen. Flora, **85**: 170–188. 9 Au. 1898. [Illust.]

Lamarliere, L. G. de. Sur les Mycocecides des *Roestelia*. Rev. Gen. de Bot. **10**: 225–237. *pl. 3, 4*. 15 Je. 1898; 276–288. 15 Jl. 1898.

Lämmermayr, L. Ueber eigenthümlich ausgebildete innere Vorspringsbildungen in den Rhizoiden von Marchantieen. Österr. Bot. Zeitsch. **48**: 321–324. S. 1898. [Illust.]

Lovell, J. H. Three fluvial Flowers and their Visitors. Asa Gray Bull. **6**: 60–65. Au. 1898.

Discusses structure of flowers and enumerates visiting insects of *Nymphaea advena*, *Sagittaria latifolia* and *Pontederia cordata*.

Lucas, F. C. Variation in the Number of Ray-flowers in the White Daisy. Am. Nat. **32**: 509–511. *f. 1–2.* Jl. 1898.

Lueders, H. F. Floral Structure of some Gramineae. Trans. Wis. Acad. Sci. **11**: 109–111. *pl. 4.* 1898.

Magnus, P. Der Mehlthau auf *Syringa vulgaris* in Nordamerika. Ber. Deutsch. Bot. Ges. **16**: 63–70. *pl. 2.* 27 Ap. 1898.

Magnus, P. Ein neues *Aecidium* auf *Opuntia* sp. aus Bolivien. Ber. Deutsch. Bot. Ges. **16**: 151–154. *pl. 8.* 25 Jl. 1898.

Malme, G. O. A: n. Nachtrag zu meinem Aufsatze: Die Burmannien der ersten Regnellschen Expedition. Bot. Not. **1898**: 185–187. 1898.

Meehan, T. *Gillenia trifoliata.* Meehan's Month. **8**: 129, 130. *pl. 9.* S. 1898.

Meehan, T. *Epipactis gigantea.* Meehan's Month. **8**: 145, 146. *pl. 10.* O. 1898.

Meehan, T. *Teucrium Canadense.* Meehan's Month. **8**: 97, 98. *pl. 7.* Jl. 1898.

Meehan, T. *Habenaria blephariglottis.* Meehan's Month. **8**: 113, 114. *pl. 8.* Au. 1898.

Meehan, T. *Rosa setigera.* Meehan's Month. **8**: 65, 66. *pl. 5.* My. 1898.

Meehan, T. *Amphicarpum Purshii.* Meehan's Month. **8**: 81, 82. *pl. 6.* Jl. 1898.

Migula, W. Weitere Untersuchungen über *Astasia asterospora* Meyer. Flora, **85**: 141–150. 23 Ap. 1898. [Illust.]

Mitrophanow, P. Beobachtungen über die Diatomeen. Flora, **85**: 293–314. 9 Au. 1898.

Molliard, M. De l'hermaphrodisme chez la mercuriale et la chauvre. Rev. Gen. de Bot. **10**: 321–334. 15 Au. 1898.

Mottier, D. M. Das Centrosom bei *Dictyota.* Ber. Deutsch. Bot. Ges. **16**: 123–128. 22 Je. 1898. [Illust.]

Mitzkewitsch. Ueber die Kerntheilung bei *Spirogyra.* Flora, **85**: 81–124. *pl. 5.* 23 Ap. 1898.

Nelson, A. New Plants from Wyoming.—IV. Bull. Torr. Bot. Club, **25**: 546–549. 15 O. 1898.

Niedenzu, F. De genere *Bunchosia* [Dissertation] 4to, pp. 19. 1898.
Includes new species from Panama and Guatemala.

Olive, E. W. A List of the Mycetozoa collected near Crawfordsville, Indiana. Proc. Ind. Acad. Sci. **1897**: 148–150. 1898.

Osterwalder, A. Beiträge zur Embryologie von *Aconitum Napellus* L. Flora, **85**: 254–292. *pl. 11–16.* 9 Au. 1898.

Parish, S. B. New or little-known Plants of Southern California. —I. Erythea, **6**: 85–92. 22 S. 1898.
Salicornia subterminalis, Eriogonum Bloomeri, Iris Hartwegi australis, Rosa Californica glabrata, Gilia tenuiflora altissima, Phacelia Davidsonii macrantha and *Nemophila Menziesii integrifolia* are proposed as new and a few changes are made in the nomenclature or rank of previously known species and varieties.

Parkin, J. On some Points in the Histology of Monocotyledons. Ann. Bot. **12**: 147–153. *pl. 13.* Je. 1898.

Patouillard, N. Champignons nouveaux ou peu connus. Bull. Soc. Myc. de France, **14**: 149–156. 31 Au. 1898.
New species in *Hyaloderma, Asterina* and *Capnodiastrum* from Brazil.

Patouillard, N. Quelques Champignons nouveaux récoltés au Mexique par Paul Maury. Bull. Soc. Myc. de France, **14**: 53–57. *pl. 7.* 31 Ap. 1898.
New species in *Xerotus, Pluteus, Hypholoma, Ganoderma, Xanthochrous, Porolaschia, Leptopotus, Lycoperdon, Nummularia* and *Maurya* gen. nov.

Peckinpah, L. A. R. Bolander's Bladdernut in Madera County, Sierra Nevada [California]. Erythea, **6**: 93, 94. 22 S. 1898.

Peckolt, T. Medicinal Plants of Brazil. Pharm. Archives **1**: 85–92. Ap. 1898.

Phillips, S. W. The Development of the Cystocarp in Rhodymemales. II. Delesseriaceæ. Am. Bot. **12**: 173–202. *pl. 15, 16.* Je. 1898.

Putnam, B. L. Determination of Sex in *Arisaema triphyllum.* Asa Gray Bull. **6**: 50–52. Je. 1898.

Raciborski, M. Ein Inhaltskorper des Leptoms. Ber. Deutsch. Bot. Ges. **16**: 52–63. 27 Ap. 1898.

Ramirez, J. Tres monstruosidades en ovarios inferos. La Naturaleza II. **3**: 125–128. *pl. 6–8.* 1898.
Colored plates of *Opuntia* sp.

Reynolds, R. The effect of Bloom on the Transpiration of Leaves. Bull. Oberlin Coll. Lab. **9**: 1–3. 15 Je. 1898.

Ross, H. Blüthenbiologische Beobachtungen an *Coboea macrostemma* Pav. Flora, **85**: 125–134. 23 Ap. 1898.

Roth, F. On the Forestry Conditions of Northern Wisconsin. Bull. Wis. Geol. and Nat. Hist. Survey, **1**: 1–78. 1898. [Map.]

Roth, F. Progress in Timber Physics. Bald Cypress (*Taxodium distichum*). Circ. U. S. Depart. Agric. (Div. Forestry) **19**: 1–24. *f. 1.* 1898.

Some data as to distribution, abundance and character of the wood.

Rothrock, J. T. Black Birch, Sweet Birch, Cherry Birch (*Betula lenta* L.). Forest Leaves, **6**: 169. Au. 1898. [Illust.]

Rothrock, J. T. The Red Spruce (*Picea nigra* Link.). Forest Leaves, **6**: 184, 185. O. 1898. [Illust.]

Rothrock, J. T. Yellow Birch, Gray Birch (*Betula lutea* Michx. f.). Forest Leaves, **6**: 152, 153. Je. 1898. [Illust.]

Schaeffer, K. L. Zur Lehre von der Reaction des Protoplasma auf thermische Reize. Flora, **85**: 135–140. 23 Ap. 1898.

Schneck, J. Do Humble Bees perforate tubular Flowers? Asa Gray Bull. **6**: 47, 48. Je. 1898.

Schröter, C. Ueber die Vielgestaltigkeit der Fichte. Vierteljahrs. naturforsch. Gesell. Zurich, **43**: 125–252. *f. 1–37.* 20 Au. 1898.

Schumann, K. *Cereus eburneus* S.-D. Monatsschr. für Kacteenkunde, **8**: 74–76. 15 My. 1898.

Schumann, K. Der Blütenbau von *Epiphyllum* und *Phyllocactus.* Monatsschr. für Kacteenkunde, **8**: 88–92. 15 Je. 1898. [Illust.]

Schumann, K. Die Kacteen in Guatemala. Monatsschr. für Kacteenkunde, **8**: 52, 53. 15 Ap. 1898.

Schumann, K. *Opuntia maculacantha* Forst. Monatsschr. für Kacteenkunde, **8**: 120. 15 Au. 1898. [Illust.]

Schumann, K. *Opuntia tessellata* Eng. var. *cristata.* Monatsschr. für Kacteenkunde, **8**: 70–73. 15 My. 1898. [Illust.]

Schumann, K. Taube Früchte bei Kacteen. Monatschr. für Kacteenkunde, **8**: 73, 74. 15 My. 1898.

Scribner, F. Lamson-. Descriptions of new or little-known Grasses. Bull. U. S. Depart. Agric. (Div. Agrost.) **11**: 42–58. *pl. 1–17. f. 2–12.* 1898.

New species in *Panicum, Chaetochloa, Stipa, Muhlenbergia, Sporobolus, Agrostis, Trisetum, Zeugites, Eragrostis, Poa, Agropyron* and *Elymus.*

Seurat, L. G. Note sur la pollinisation des Cactées. Rev. Gen. de Bot. **10**: 191, 192. 15 My. 1898.

Seurat, L. G. Sur la culture des plantes européennes a Mexico. Rev. Gen. de Bot. **10**: 273–275. 15 Jl. 1898. [Illust.]

Snyder, L. The Germ of Pear Blight. Proc. Ind. Acad. Sci. **1897**: 150–156. 1898.

Sokolowa, C. Über das Wachsthum der Wurzelhaare u. Rhizoiden. Bull. Soc. Imp. Nat. Moscou, **1897**: 167–270. *f. 1–22.* 1897.

Steinbrinck, C. Ist die Cohäsion des schwendenden Füllwassers der dynamischen Zellen die Ursache der Schrumpfungsbewegungen von Antherenklappen, Sporangien, und Moosblättern? Ber. Deutsch. Bot. Ges. **16**: 97–103. 25 My. 1898.

Ule, E. Ueber Blütheneinrichtungen einer Aristolochien in Brasilien. Ber. Deutsch. Bot. Ges. **16**: 72–91. *pl. 3.* 25 My. 1898.

Underwood, L. M. The ternate Species of *Botrychium.* Bull. Torr. Bot. Club, **25**: 521–541. 15 O. 1898.

Fifteen species recognized; *B. Coulteri* and *B. occidentale* new.

Van Tieghem, P. Sur le genre Penthore, considéré comme type d'une famille nouvelle, les Penthoracées. Jour. de Bot. **12**: 150–154. 16 My. 1898.

Villada, M. M. El *Erythroxylon ellipticum* J. Ram. La Naturalseza, II. **5**: 53–55. *pl. 4.* 1898.

Vöchting, H. Ueber den Einfluss niedriger Temperatur auf die Sprossrichtung. Ber. Deutsch. Bot. Ges. **16**: 37–52. 27 Ap. 1898. [Illust.]

Wadmond, S. C. Leaf Retardation in *Podophyllum peltatum.* Asa Gray Bull. **6**: 66, 67. Au. 1898.

Wadmond, S. C. The Indian Plantain. Asa Gray Bull. **6**: 52. 1898.

Discusses local variety of *Cacalia reniformis.*

Webb, R. J. Pollination of the closed Gentian by Bumblebees. Am. Nat. **32**: 265. Ap. 1898.

Williams, E. M. Three common *Lepiotas.* Asa Gray Bull. **6**: 57–60. *f. 11.* Au. 1898.

Describes and figures *L. procera* Scop., *L. naucinoides* Peck, and *L. Morgani* Peck.

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